FIG. 1

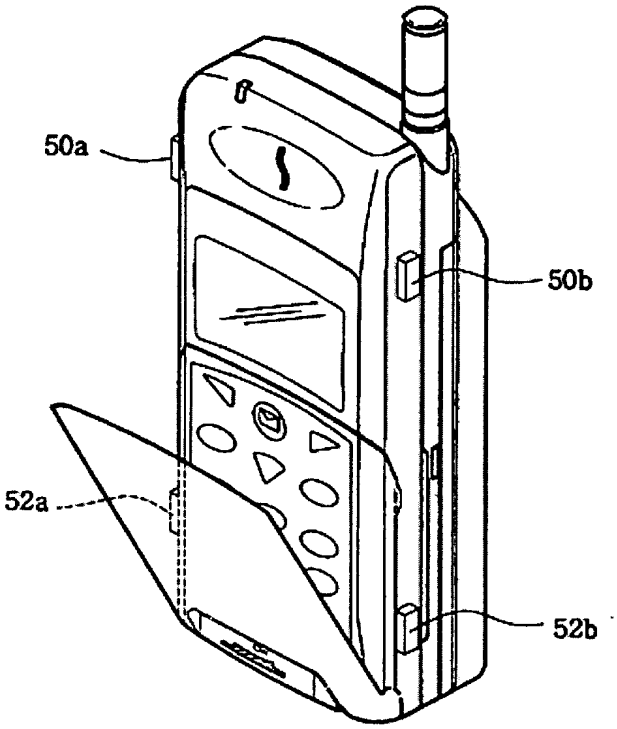


FIG. 2

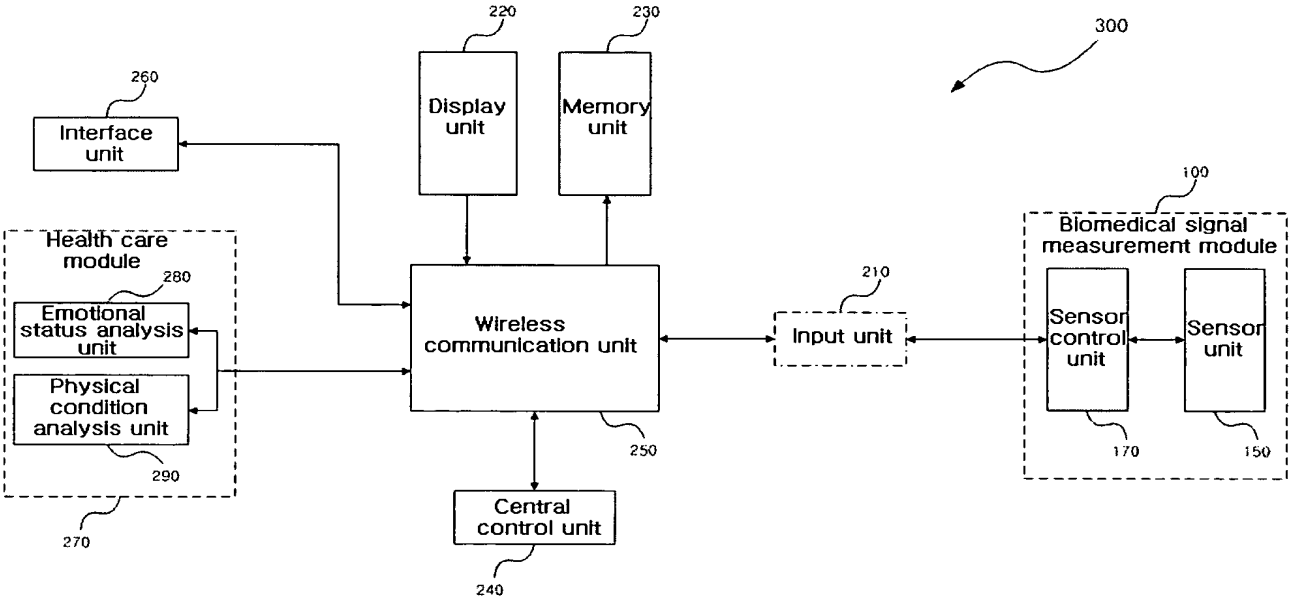

220
230
300
260
Display unit
Memory unit
Interface unit
100
Health care module
Biomedical signal measurement module
280
210
Emotional status analysis unit
Wireless communication unit
Input unit
Sensor control unit
Sensor unit
Physical condition analysis unit
250
290
170
150
270
Central control unit
240

FIG. 3

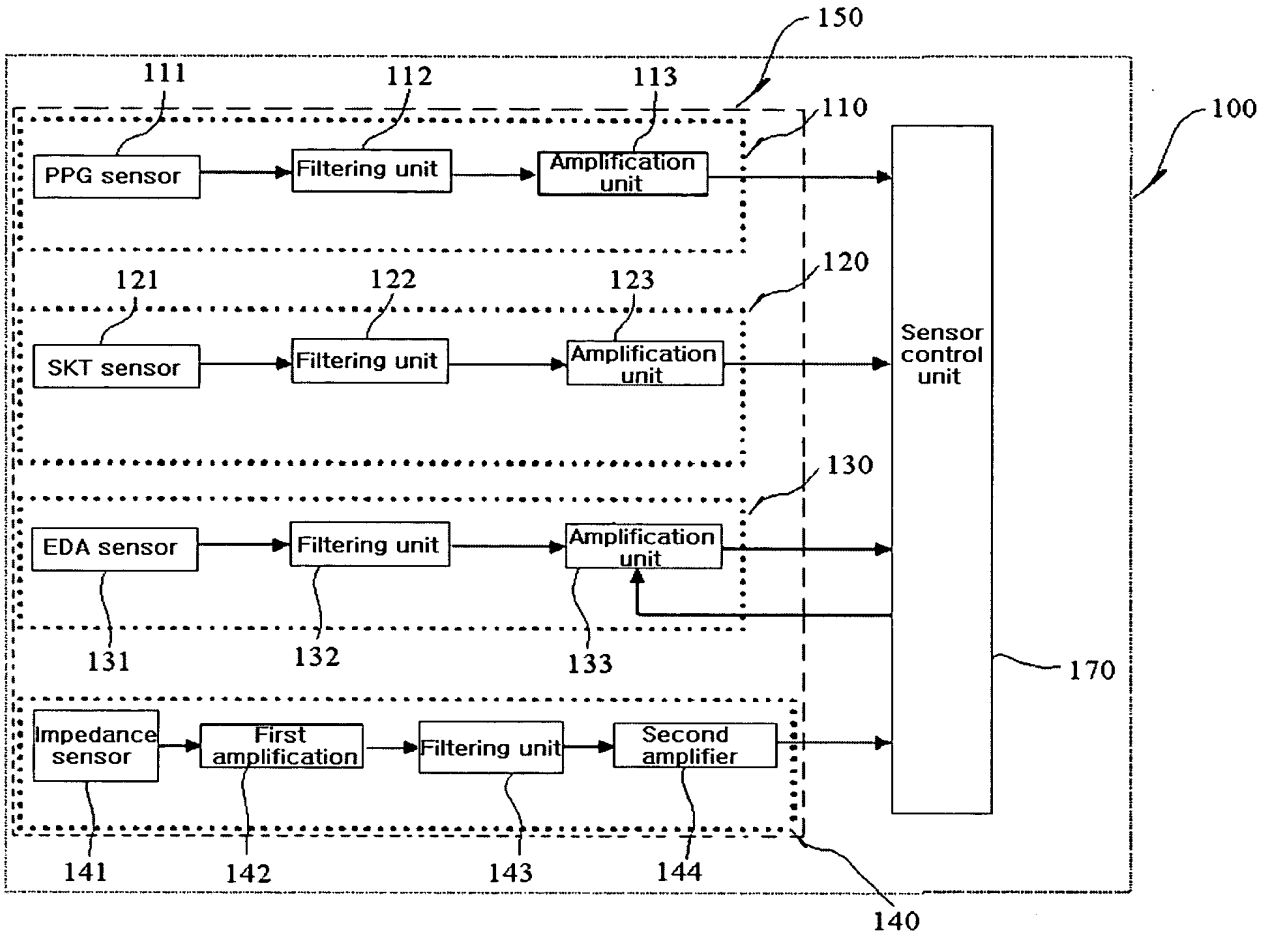

150
111
112
113
110
100
PPG sensor
Filtering unit
Amplification unit
120
121
122
123
SKT sensor
Filtering unit
Amplification unit
Sensor control unit
130
EDA sensor
Filtering unit
Amplification unit
131
132
133
170
Impedance sensor
First amplification
Filtering unit
Second amplifier
141
142
143
144
140

FIG. 4

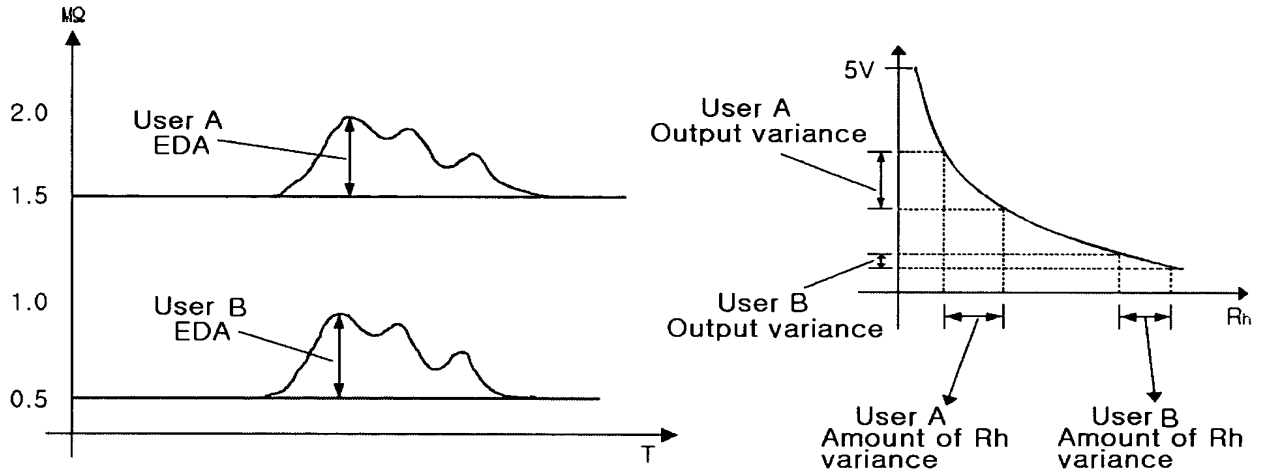

MΩ
2.0
1.5
1.0
0.5
User A
EDA
User B
EDA
T
5V
User A
Output variance
User B
Output variance
Rh
User A
Amount of Rh
variance
User B
Amount of Rh
variance

FIG. 5

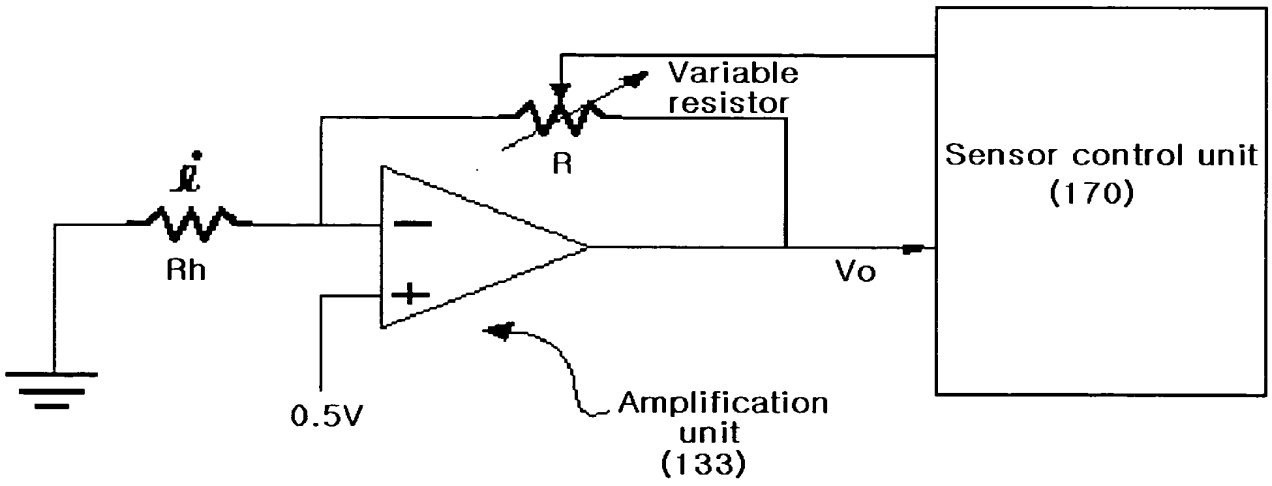

Variable
resistor
R
Rh
Vo
0.5V
Amplification
unit
(133)
Sensor control unit
(170)

FIG. 6

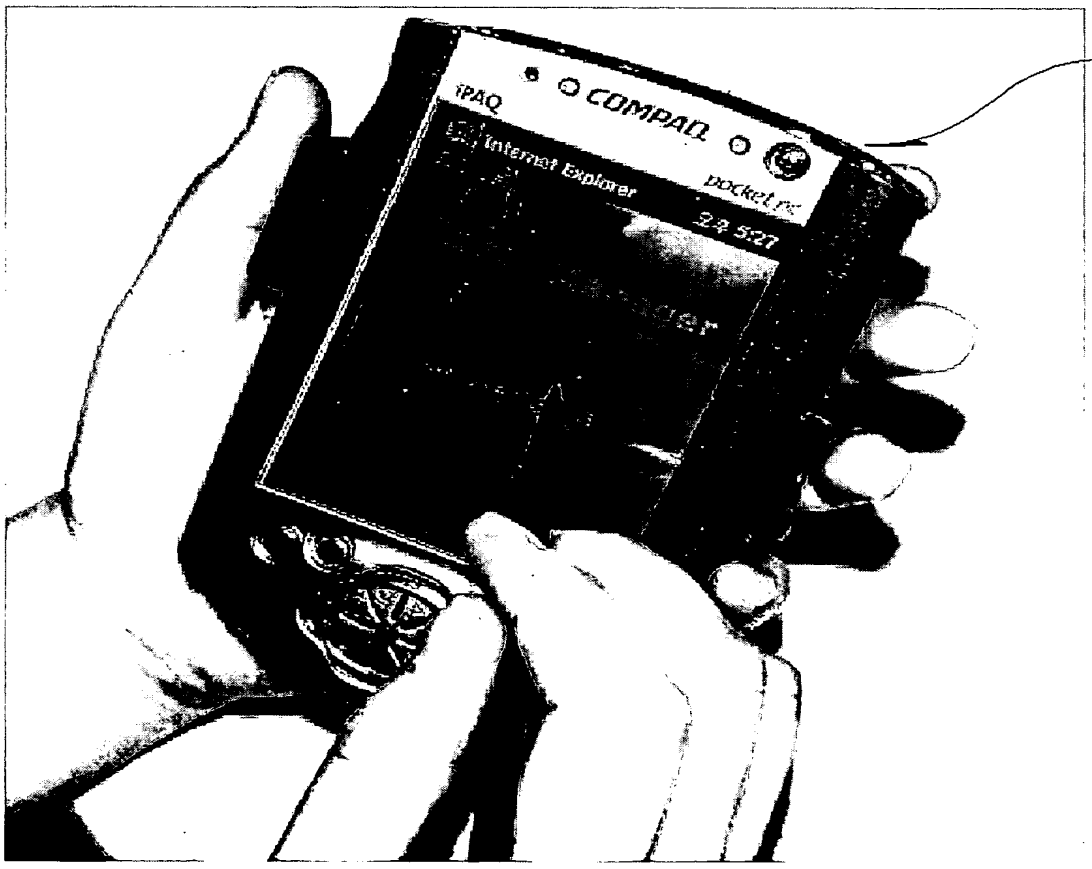


FIG. 7

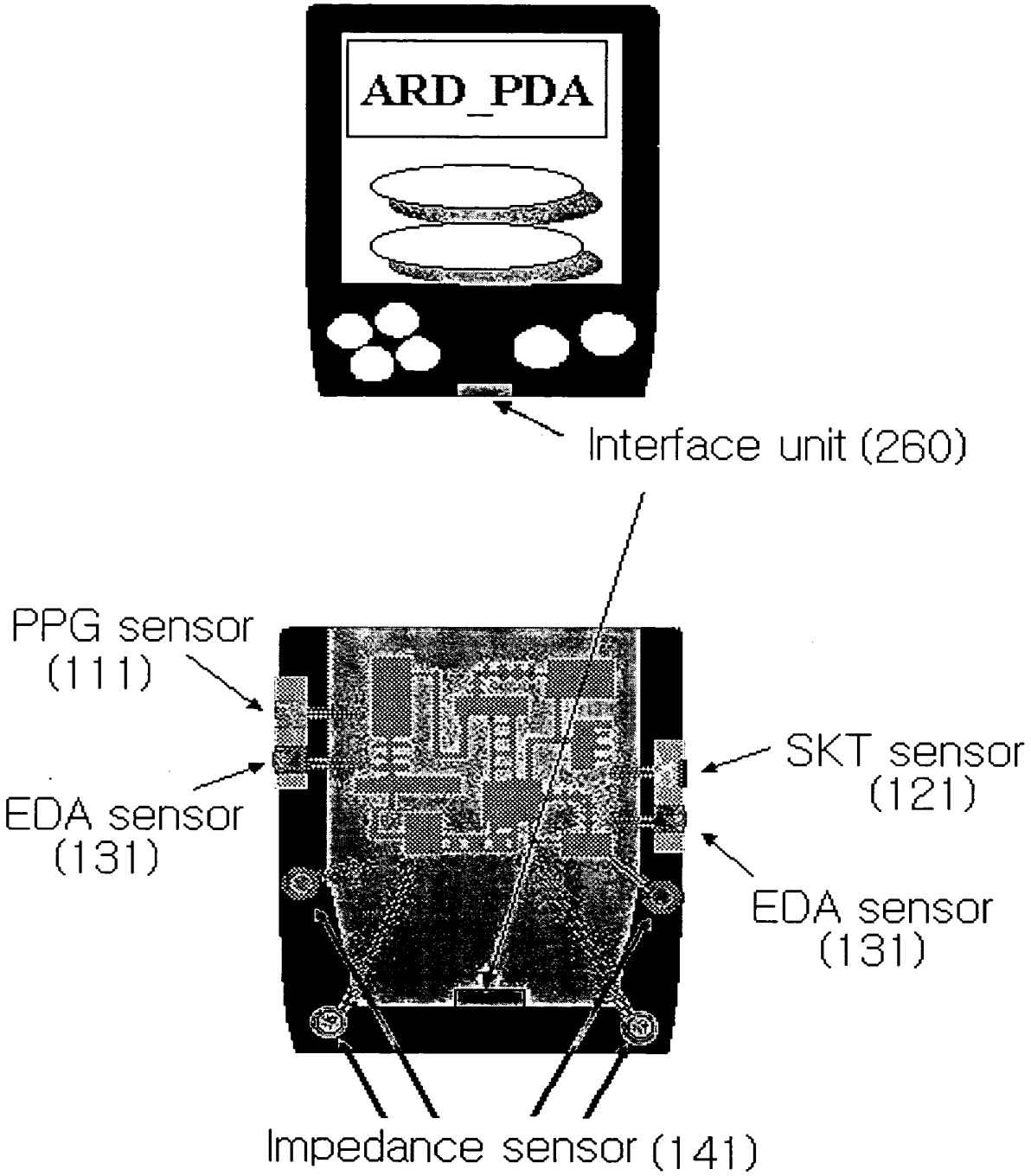

ARD_PDA
Interface unit (260)
PPG sensor (111)
EDA sensor (131)
SKT sensor (121)
EDA sensor (131)
Impedance sensor (141)

FIG. 8

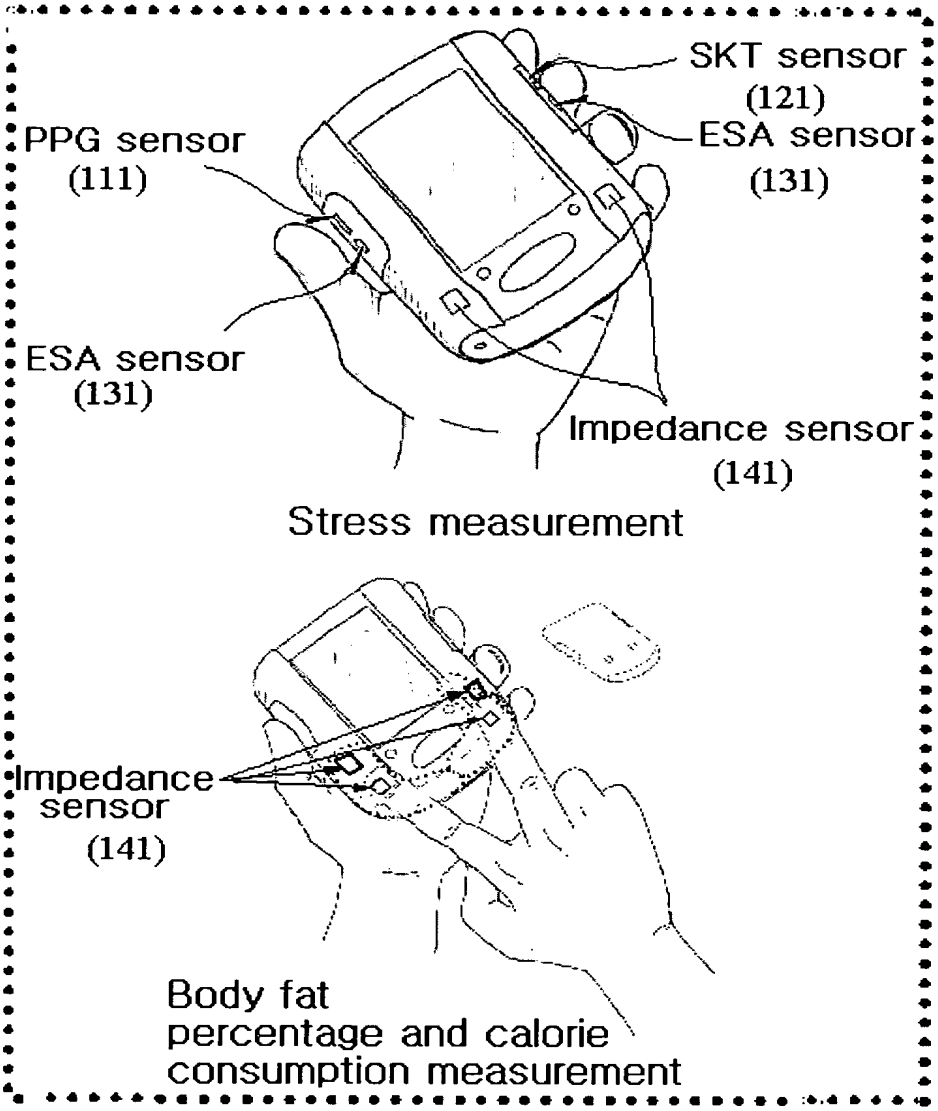

SKT sensor
(121)
PPG sensor
(111)
ESA sensor
(131)
ESA sensor
(131)
Impedance sensor
(141)
Stress measurement
Impedance
sensor
(141)
Body fat
percentage and calorie
consumption measurement

FIG. 9

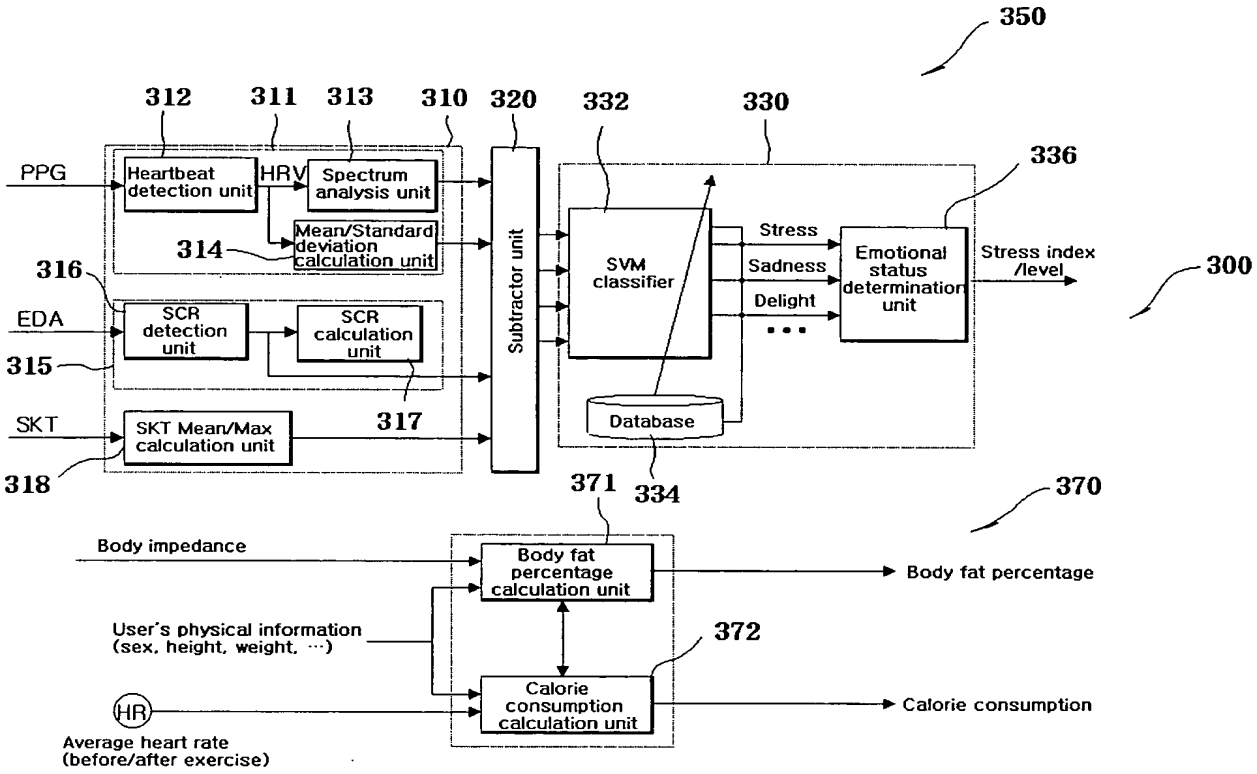

350
312
311
313
310
320
332
330
336
PPG
Heartbeat detection unit
HRV
Spectrum analysis unit
Mean/Standard deviation calculation unit
314
316
EDA
SCR detection unit
SCR calculation unit
315
317
SKT
SKT Mean/Max calculation unit
318
Subtractor unit
SVM classifier
Stress
Sadness
Delight
Emotional status determination unit
Stress index /level
300
Database
371
334
370
Body impedance
Body fat percentage calculation unit
Body fat percentage
User's physical information (sex, height, weight, ···)
372
HR
Average heart rate (before/after exercise)
Calorie consumption calculation unit
Calorie consumption

FIG.. 10

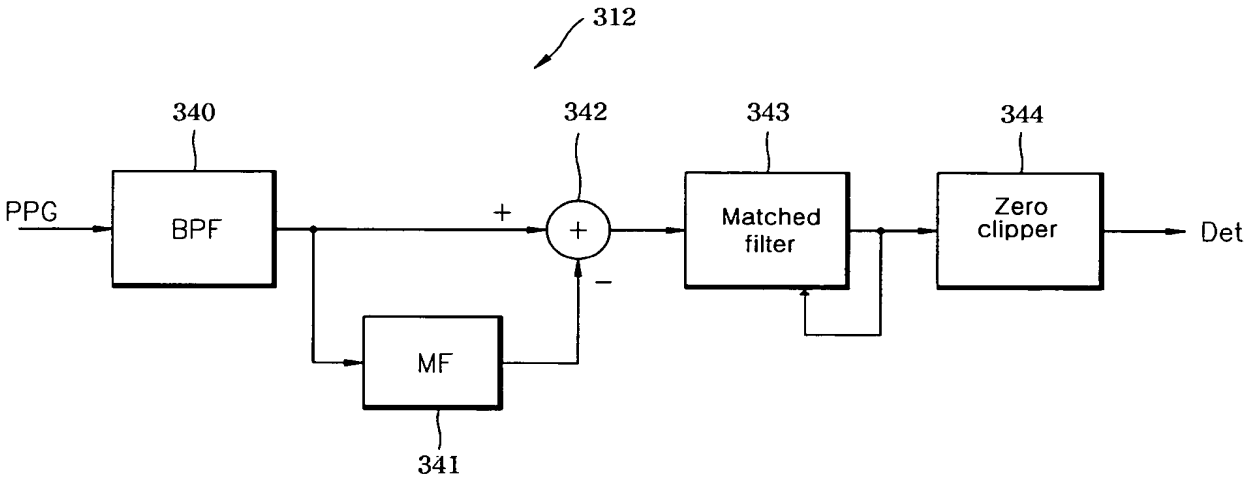

312
340
342
343
344
PPG
BPF
+
+
−
Matched filter
Zero clipper
Det
MF
341

FIG. 11

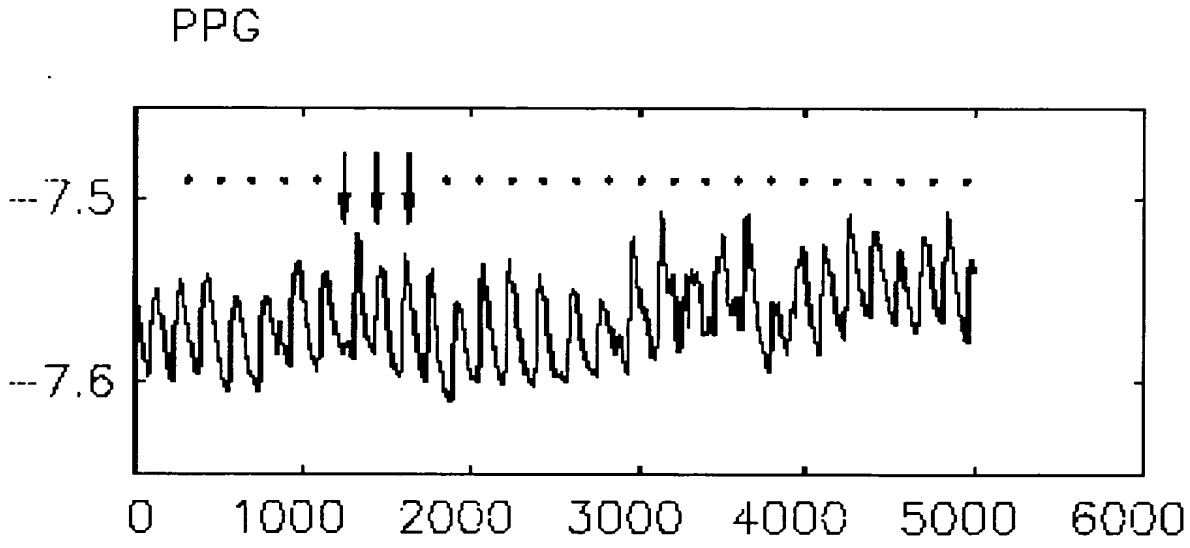

PPG
7.5
7.6
0
1000
2000
3000
4000
5000
6000

FIG. 12

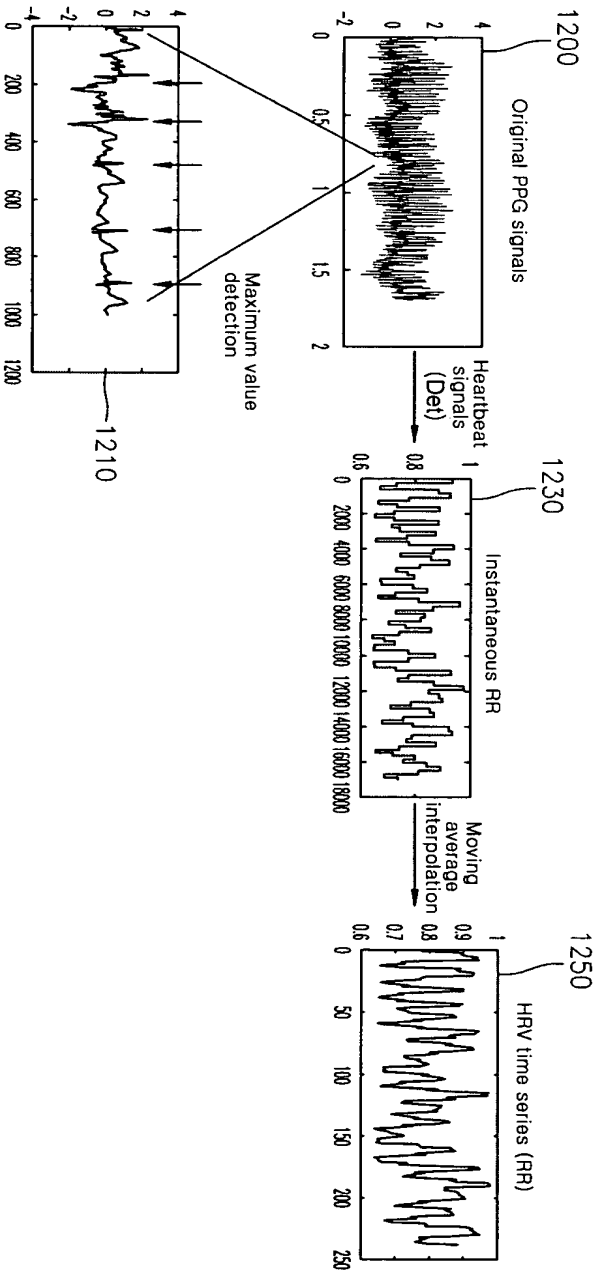

1200
Original PPG signals
Heartbeat signals (Det)
Maximum value detection
1210
1230
Instantaneous RR
Moving average interpolation
1250
HRV time series (RR)

FIG. 13

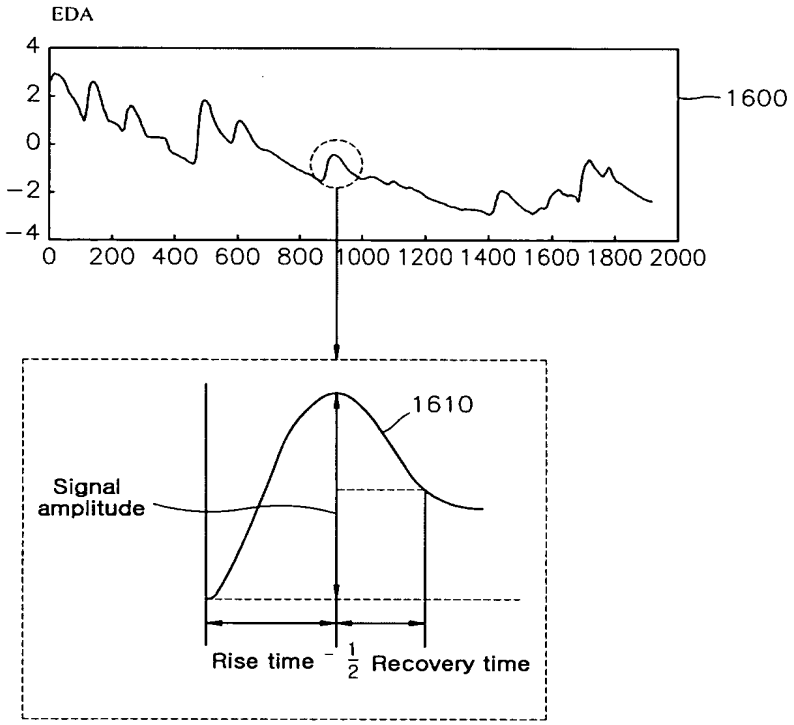

EDA
4
2
0
−2
−4
0 200 400 600 800 1000 1200 1400 1600 1800 2000
1600
1610
Signal amplitude
Rise time
1/2
Recovery time

FIG. 14

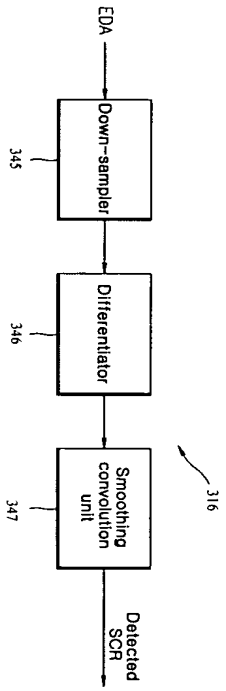

EDA
Down-sampler
345
Differentiator
346
Smoothing convolution unit
347
316
Detected SCR

FIG. 15

89.2
89.1
89
88.9
88.8
88.7
88.6
88.5
88.4
0
50
100
150
200
250
300
350

FIG. 16

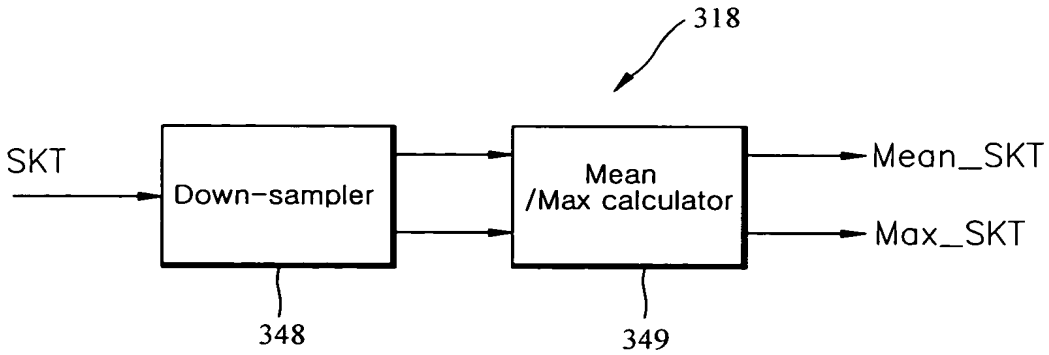

318
SKT
Down-sampler
Mean
/Max calculator
Mean_SKT
Max_SKT
348
349

FIG. 17a

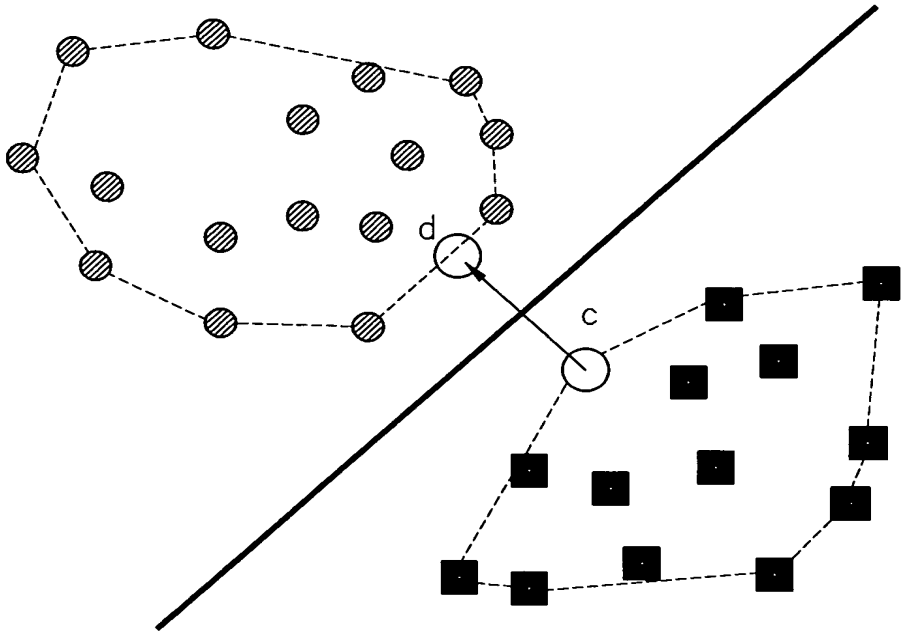


FIG. 17b

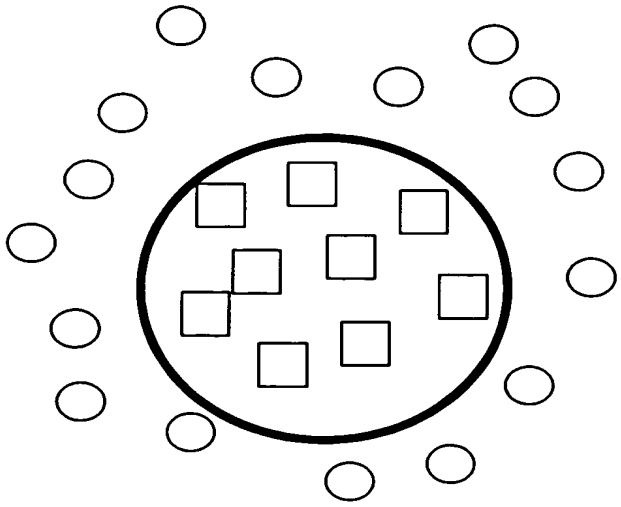


FIG. 18

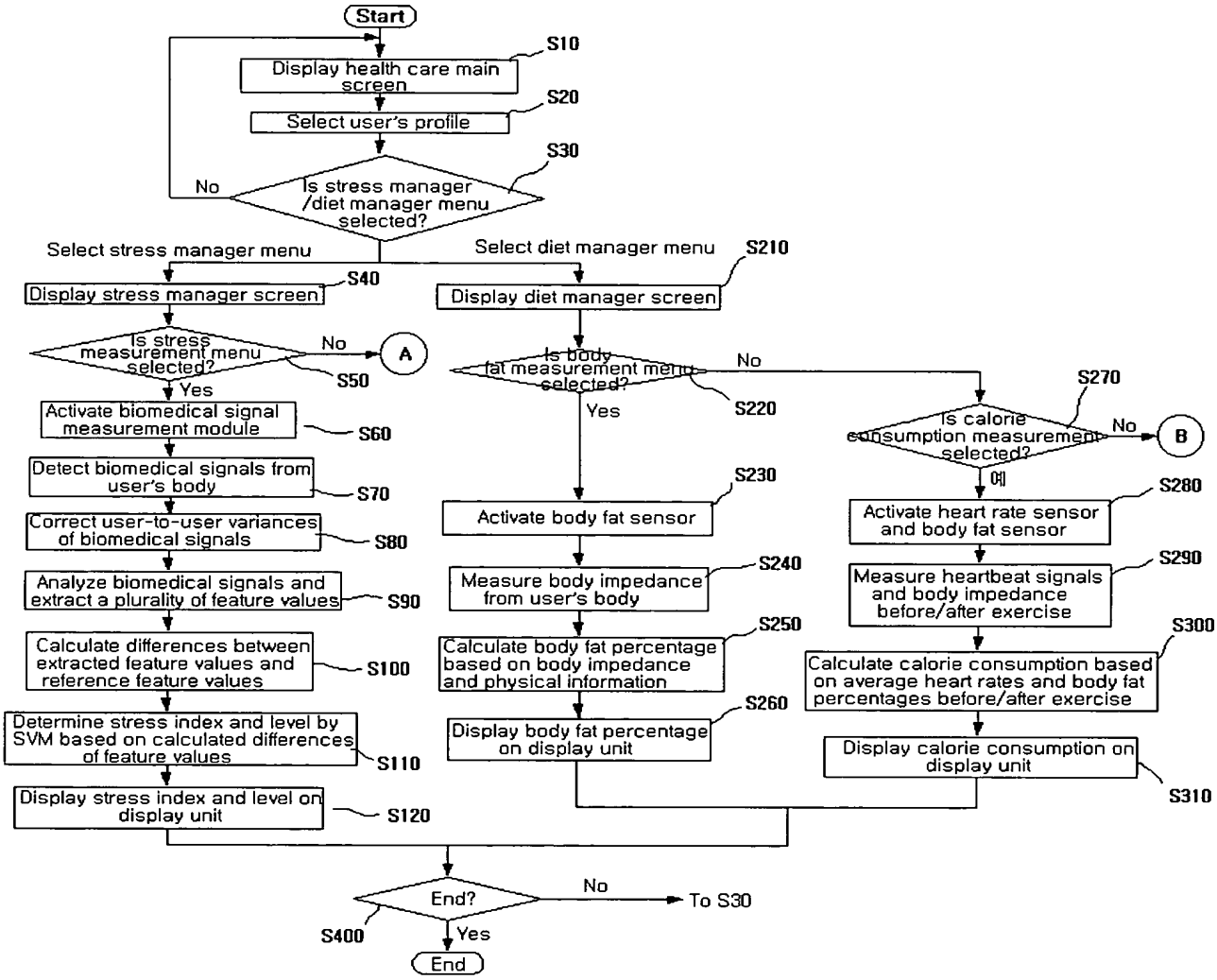

Start
S10
Display health care main screen
S20
Select user's profile
S30
Is stress manager /diet manager menu selected?
No
Select stress manager menu
Select diet manager menu
S210
S40
Display stress manager screen
Display diet manager screen
Is stress measurement menu selected?
No
A
S50
Yes
Activate biomedical signal measurement module
S60
Detect biomedical signals from user's body
S70
Correct user-to-user variances of biomedical signals
S80
Analyze biomedical signals and extract a plurality of feature values
S90
Calculate differences between extracted feature values and reference feature values
S100
Determine stress index and level by SVM based on calculated differences of feature values
S110
Display stress index and level on display unit
S120
Is body fat measurement menu selected?
No
S220
Yes
S230
Activate body fat sensor
S240
Measure body impedance from user's body
S250
Calculate body fat percentage based on body impedance and physical information
S260
Display body fat percentage on display unit
S270
Is calorie consumption measurement selected?
No
B
Yes
S280
Activate heart rate sensor and body fat sensor
S290
Measure heartbeat signals and body impedance before/after exercise
S300
Calculate calorie consumption based on average heart rates and body fat percentages before/after exercise
Display calorie consumption on display unit
S310
End?
No
To S30
S400
Yes
End

FIG. 19

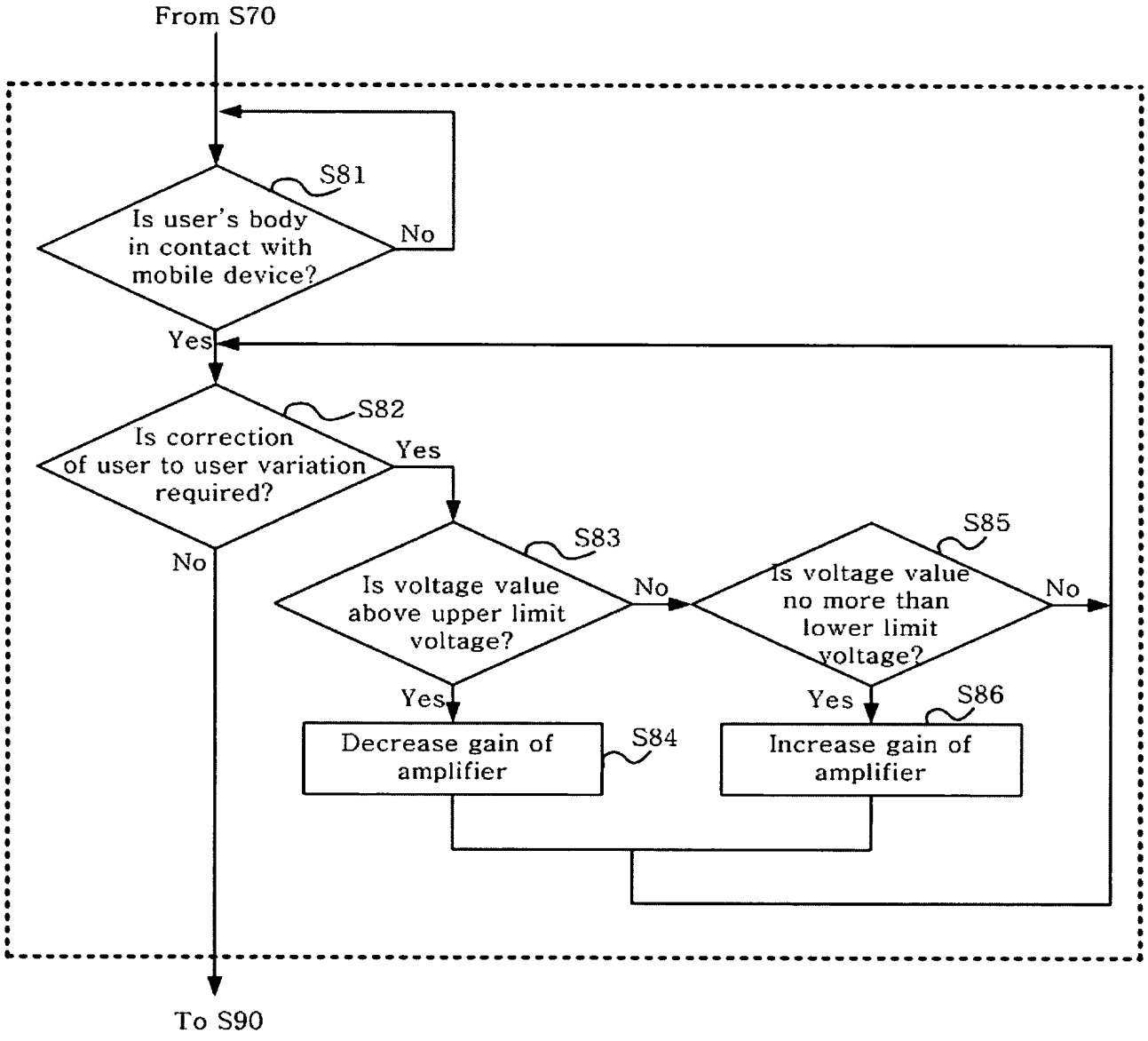

From S70
S81
Is user's body in contact with mobile device?
No
Yes
S82
Is correction of user to user variation required?
Yes
No
S83
Is voltage value above upper limit voltage?
No
S85
Is voltage value no more than lower limit voltage?
No
Yes
Decrease gain of amplifier
S84
Yes
S86
Increase gain of amplifier
To S90

FIG. 20

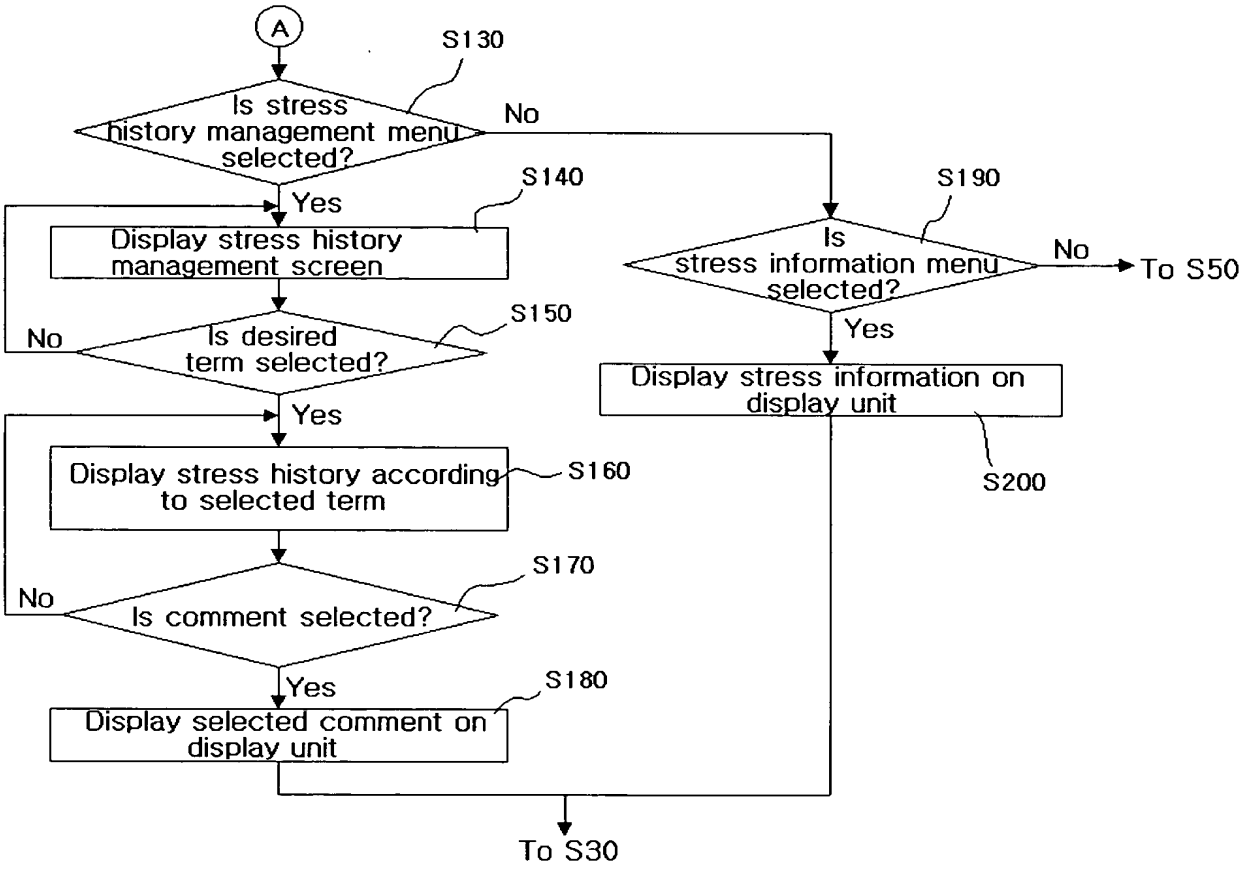

A
S130
Is stress history management menu selected?
No
Yes
S140
Display stress history management screen
S150
No
Is desired term selected?
Yes
Display stress history according to selected term
S160
S170
No
Is comment selected?
Yes
S180
Display selected comment on display unit
S190
Is stress information menu selected?
No
To S50
Yes
Display stress information on display unit
S200
To S30

FIG. 21

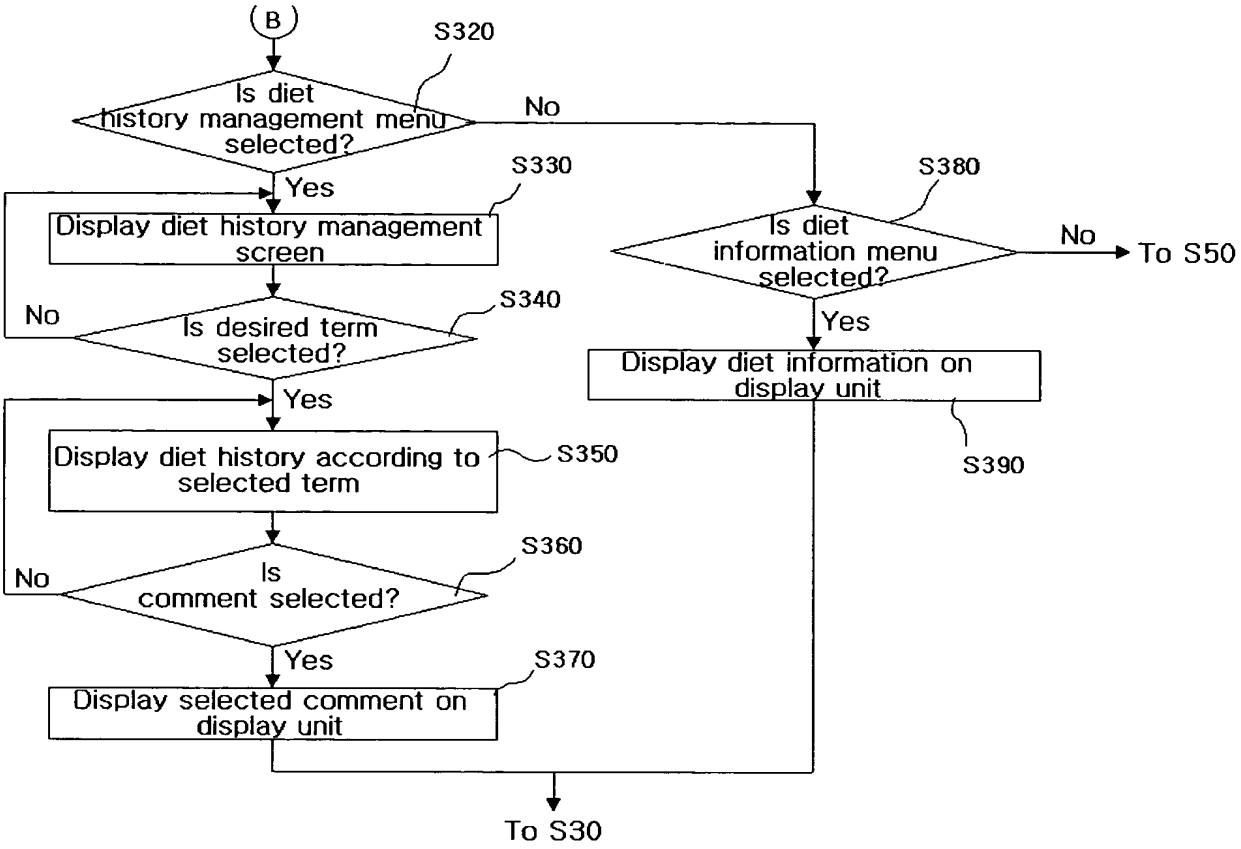

B
S320
Is diet history management menu selected?
No
Yes
S330
Display diet history management screen
No
S340
Is desired term selected?
Yes
Display diet history according to selected term
S350
S360
No
Is comment selected?
Yes
S370
Display selected comment on display unit
S380
Is diet information menu selected?
No
To S50
Yes
Display diet information on display unit
S390
To S30

FIG. 22

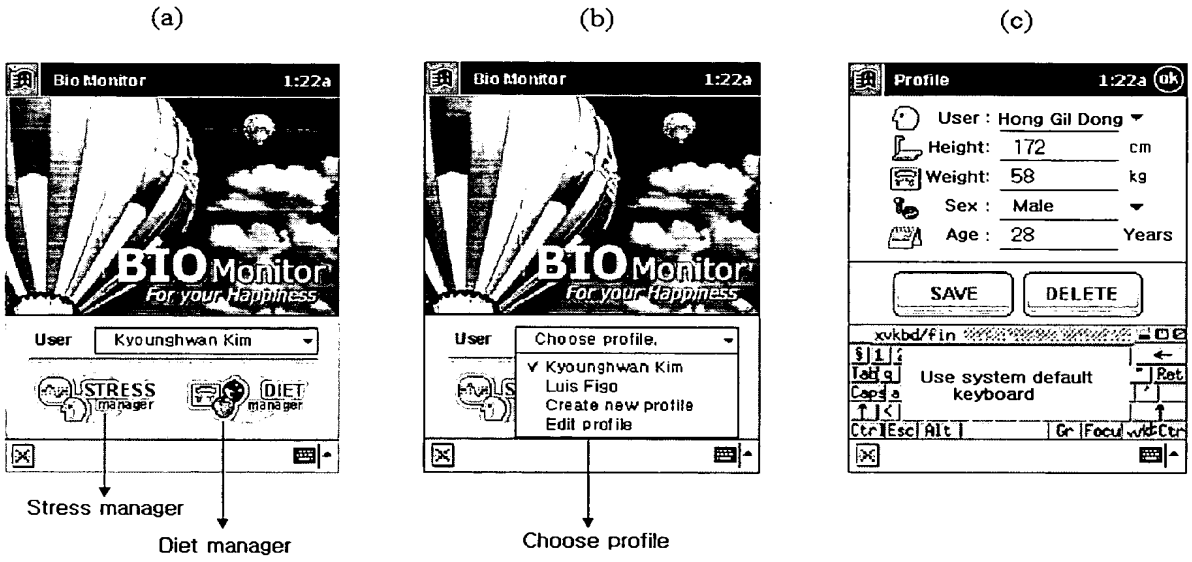

(a)
(b)
(c)
Bio Monitor
1:22a
BIO Monitor
For your Happiness
User
Kyounghwan Kim
STRESS manager
DIET manager
Stress manager
Diet manager
Choose profile.
Kyounghwan Kim
Luis Figo
Create new profile
Edit profile
Choose profile
Profile
User : Hong Gil Dong
Height: 172 cm
Weight: 58 kg
Sex : Male
Age : 28 Years
SAVE
DELETE
xvkbd/fin
Use system default keyboard

FIG. 23a

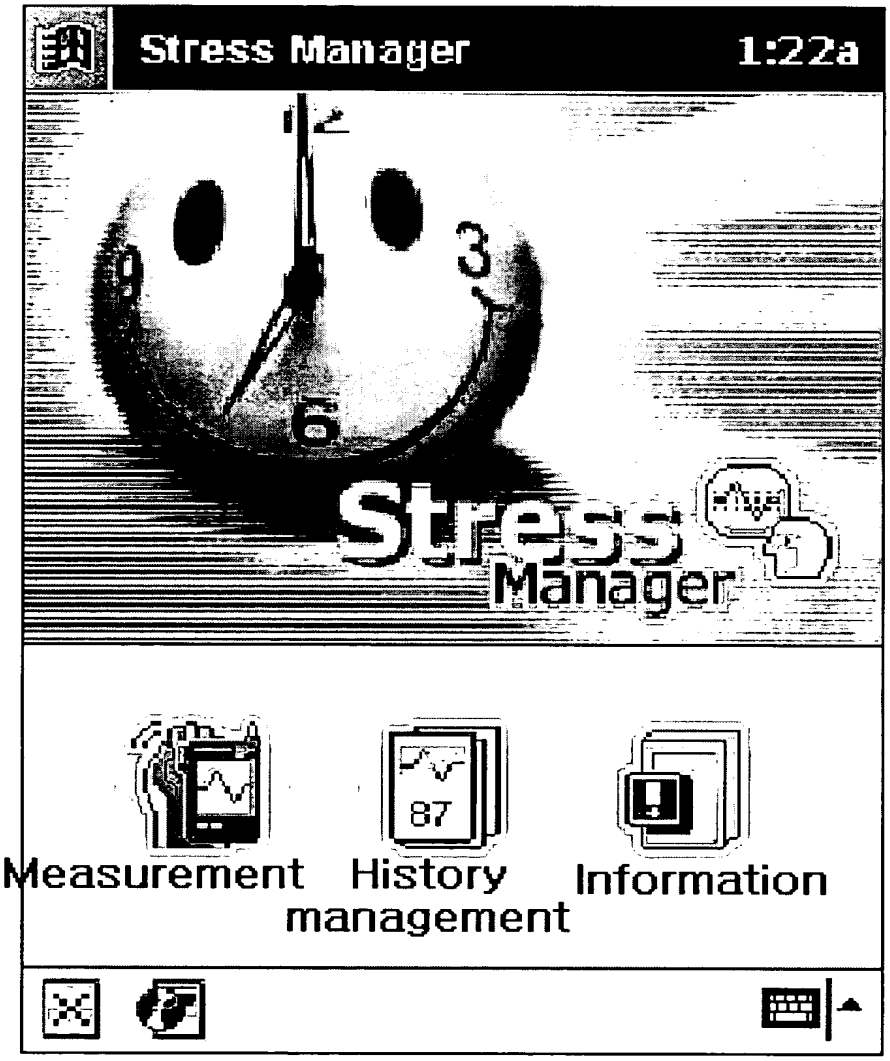

Stress Manager
1:22a
Stress
Manager
87
Measurement
History management
Information

FIG. 23b

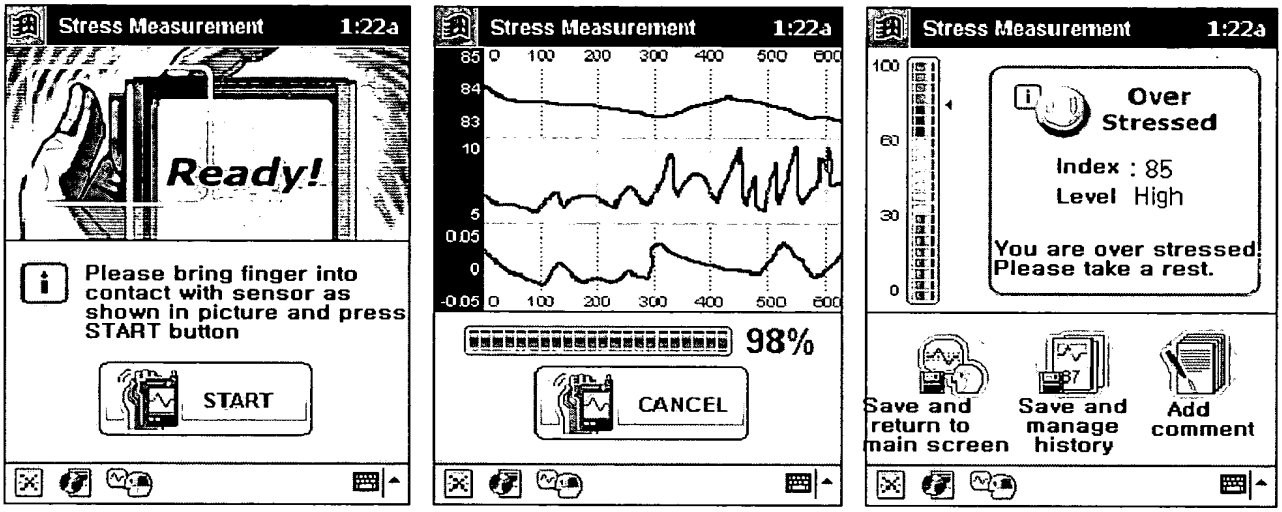


FIG. 23c

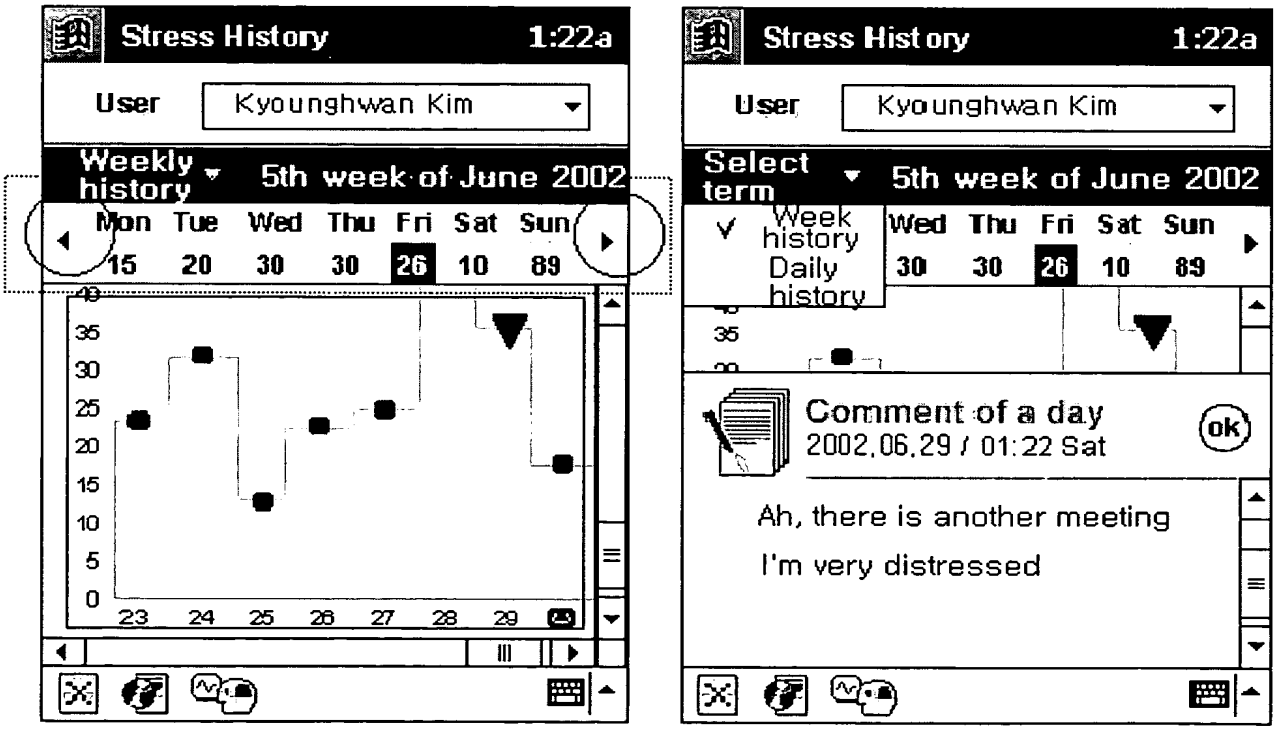


FIG. 23d

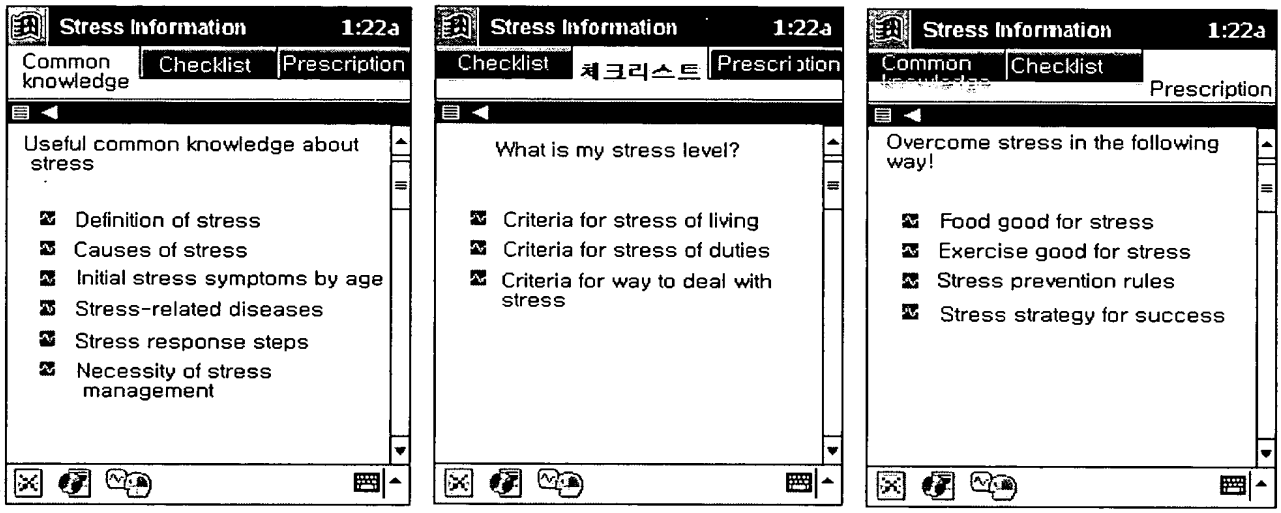

Stress Information 1:22a
Common knowledge
Checklist
Prescription
Useful common knowledge about stress
Definition of stress
Causes of stress
Initial stress symptoms by age
Stress-related diseases
Stress response steps
Necessity of stress management
Stress Information 1:22a
Checklist
체크리스트
Prescription
What is my stress level?
Criteria for stress of living
Criteria for stress of duties
Criteria for way to deal with stress
Stress Information 1:22a
Common
Checklist
Prescription
Overcome stress in the following way!
Food good for stress
Exercise good for stress
Stress prevention rules
Stress strategy for success

FIG. 24a

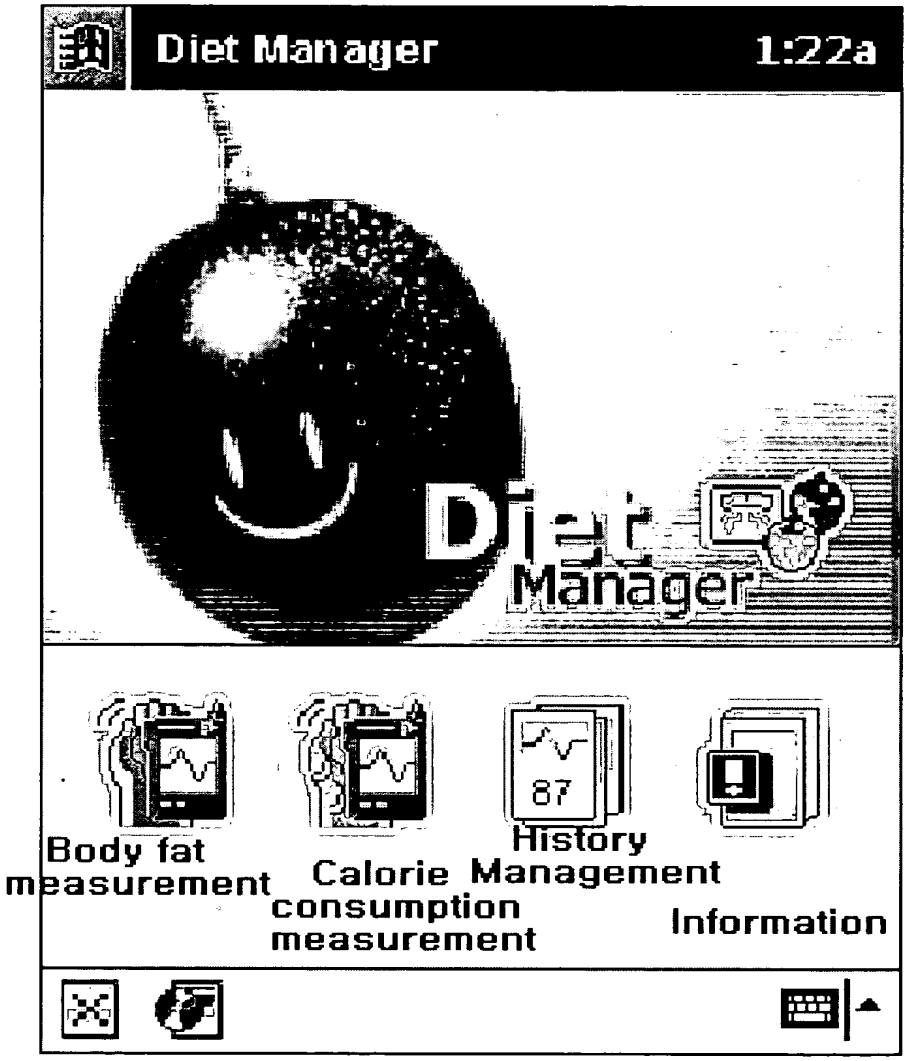

Diet Manager
1:22a
Diet
Manager
87
Body fat measurement
Calorie consumption measurement
History Management
Information

FIG. 24b

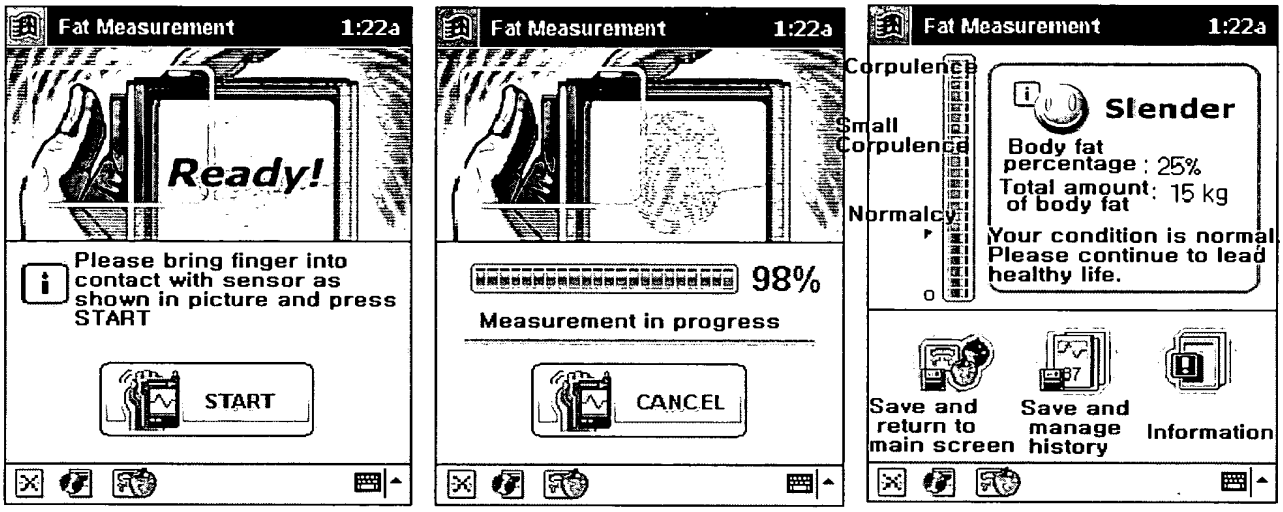


FIG. 24c

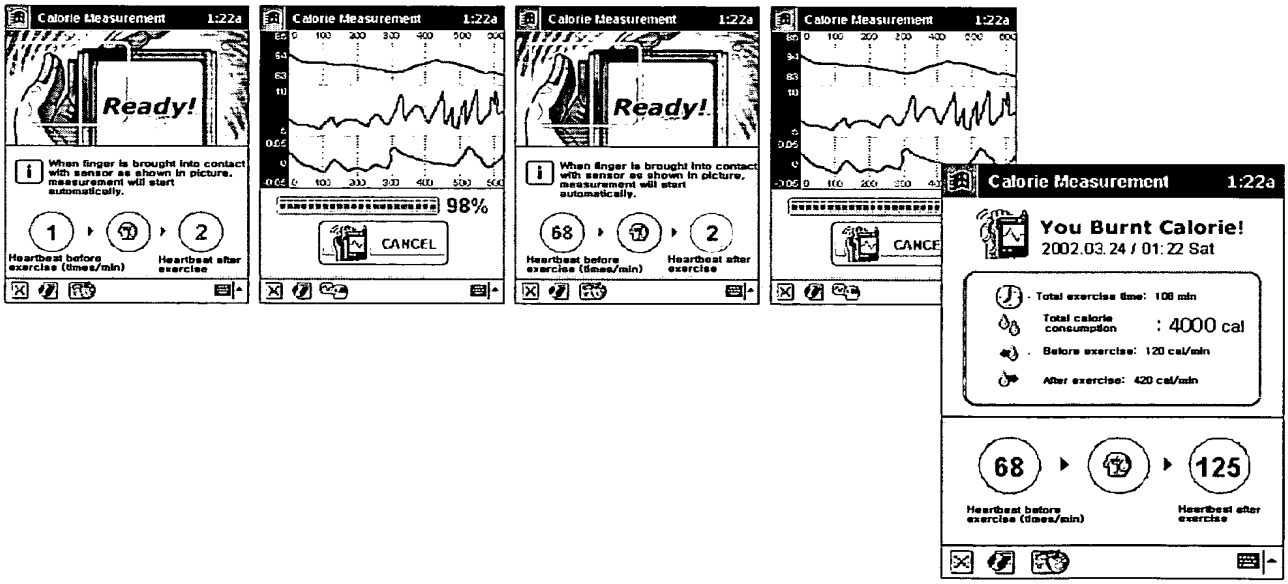


FIG. 24d

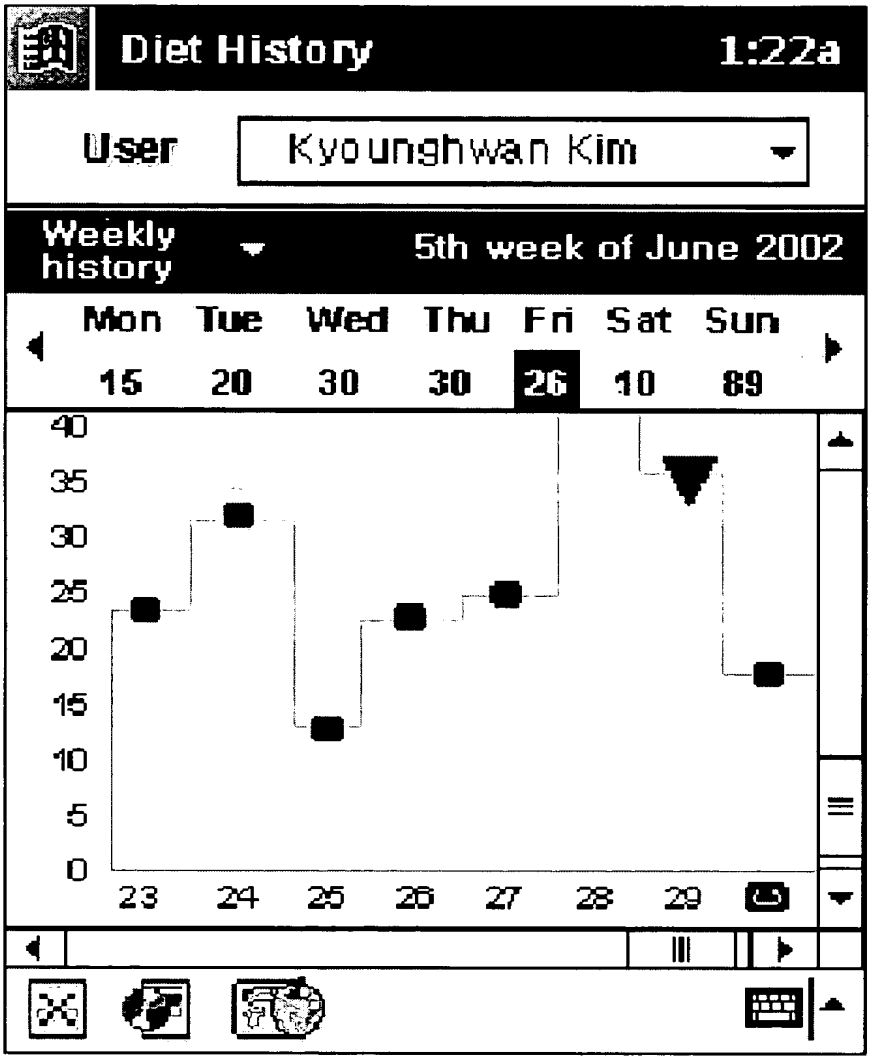
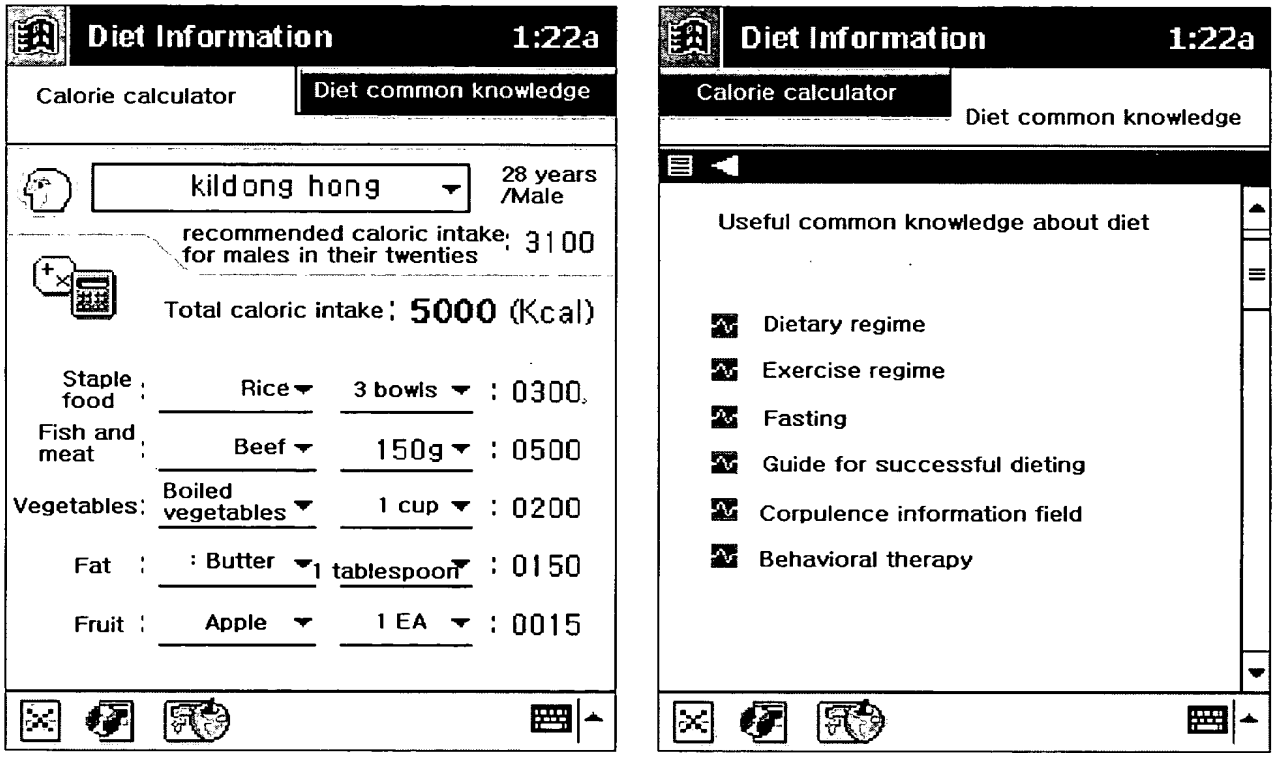

Diet History
1:22a
User
Kyounghwan Kim
Weekly history
5th week of June 2002
Mon Tue Wed Thu Fri Sat Sun
15 20 30 30 26 10 89
40
35
30
25
20
15
10
5
0
23 24 25 26 27 28 29

FIG. 24e


Diet Information
1:22a
Calorie calculator
Diet common knowledge
kildong hong
28 years /Male
recommended caloric intake for males in their twenties : 3100
Total caloric intake : 5000 (Kcal)
Staple food : Rice 3 bowls : 0300
Fish and meat : Beef 150g : 0500
Vegetables : Boiled vegetables 1 cup : 0200
Fat : Butter 1 tablespoon : 0150
Fruit : Apple 1 EA : 0015
Diet Information
1:22a
Calorie calculator
Diet common knowledge
Useful common knowledge about diet
Dietary regime
Exercise regime
Fasting
Guide for successful dieting
Corpulence information field
Behavioral therapy